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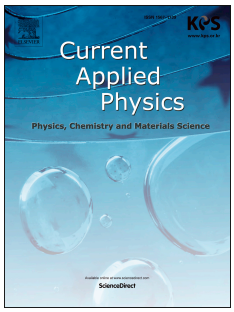

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Short-range magnetic order in $La_{1-x}Ba_xCoO_3$ cobaltites

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Abstract

Magnetization versus temperature and magnetic-field measurements, $M(T, H_a)$, have been carried out to study the magnetic and critical properties of polycrystalline $La_{1-x}Ba_xCoO_3$ (x = 0.3 and 0.5) cobaltites. These compounds with the density of ~6.2 g/cm^3 crystallized in the $R\bar{3}c$ rhombohedral and $Pm\bar{3}m$ cubic structures, respectively. With an applied field H_a = 200 Oe, $M(T)$ data have revealed that the samples with x = 0.3 and 0.5 exhibit the ferromagnetic-paramagnetic (FM-PM) phase transition at the Curie temperature points T_C = 202 and 157 K, respectively. At 4.2 K, the saturation magnetization (M_{sat}) decreases from 35.9 emu/g for x = 0.3 to 26.1 emu/g for x = 0.5. Particularly, the critical-behavior analyses in the vicinity of T_C reveal all samples undergoing a second-order phase transition, with critical exponent values (β = 0.328 and γ = 1.251 for x = 0.3, and β = 0.331 and γ = 1.246 for x = 0.5) close to those expected for the 3D Ising model. This proves short-range magnetic order existing in $La_{1-x}Ba_xCoO_3$. We believe that magnetic inhomogeneities due to the mixture of hole-rich FM regions (confined in the trivalent-cobalt hole-poor anti-FM matrix) and uniaxial anisotropy prevent long-range order in $La_{1-x}Ba_xCoO_3$.

Keywords: Perovskite cobaltites; magnetic properties; critical behavior; second-order phase transition; short-range order

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